A collection of Mathematical and Statistical routines in Fortran 90

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The purpose of this brief note is to bring to the attention of readers a collection of Fortran routines which may be useful to readers of this journal. The author collected the routines over many years, starting while acting as a statistical consultant in CSIRO (Commonwealth Scientific and Industrial Research Organization, Australia). Though most statistical analysis is now done using statistical packages, code in Fortran and other languages is useful for instance when developing new tests or estimates, or for finding maximum likelihood estimates in complex cases.

The author's web site is at:
http://users.bigpond.net.au/amiller/

When the user logs into this web site, they find a number of section headings. The notes below describe briefly what is in each section.

Subset selection in regression
This section contains the author's own least-squares software, a version of which was published as Applied Statistics algorithm AS 274, together with the software referred to in the author's book 'Subset Selection in Regression' (Miller(2002)).

Random numbers
A collection of generators of random numbers from the uniform distribution, plus generators of random numbers from many other distributions (normal, Poisson, gamma, etc.).

Quadruple precision
Double precision on a PC represents numbers to about 16 decimal digits.

Here is software to do calculations to double this accuracy – but much more SLOWLY!! Sometimes also known as doubledouble precision.

Some Applied Statistics algorithms
Here are Fortran 90 versions of some of the most useful of the algorithms published in the Royal Statistical Society's journal 'Applied Statistics'. This section contains the most frequently downloaded routine from this web site - it is the CHIRP routine for the FFT for series of any length.
Logistic regression
Code for fitting a linear logistic model.

Miscellaneous TOMS algorithm
A variety of algorithms including:

- Solving polynomial equations.
- Calculation of Kolmogorov-Smirnov probabilities.
- Solution of sparse linear equations.
- Code for linear regression using the L_1-norm.
- Fitting a cubic spline using generalized cross-validation.
- Fisher's exact test for 2-way contingency tables.
- Global minimization using a stochastic algorithm (includes 37 test problems).
- Many special functions including statistical distribution functions, Bessel and Airy functions, the confluent hypergeometric, the Dawson and psi functions, and many more.
- Several algorithms for constrained and uncontrained minimization.
- ... and more!

Code from the NSWC library
The Naval Surface Warfare Center's library of routines in Fortran is of very high quality. It was written and collected over many years by Alfred Morris. A wide range of mathematics is covered, particularly special functions. There is an FFT routine for any series length which has no prime factor greater than 23. There is also a quicksort routine which does not change

the order in the input array. There are also solvers of quadratic, cubic and quartic equations, and of a user-supplied non-linear function.

Miscellaneous code

Includes several more minimization algorithms, including the Nelder-Mead simplex algorithm which does not use derivatives. Also code for bivariate and trivariate normal integration, for the singular-value decomposition, and for calculating eigenvalues and vectors of symmetric banded matrices, for non-linear least-squares fitting, and much more including even more special functions. The TENSOLVE and NNES packages are both for solving sets of non-linear equations. There are more routines for the FFT. There is date manipulating code including code for calculating the date of Easter, and the classic Adventure game. There is code for finding the median using a kind of quicksort algorithm.

Reference

Miller, A.J. (2002) Subset selection in regression (2nd edition), Chapman & Hall / CRC Press, London and New York.